



Contribution ID: 131

Type: **Oral Contribution**

Plasma acceleration - what were we thinking in those early days and where are we headed?

Wednesday, 8 May 2019 18:30 (1 hour)

The concept of particle acceleration using collective field generated by charge separation of ions and electrons in a plasma, predated the now famous Tajima and Dawson paper. The many avatars of this concept had had a modest success, until Dawson proposed using a relativistic plasma wave to accelerate electrons. The initial response to this paper was either total disbelief or skepticism. It was in this climate that the UCLA - Laser-Plasma Group (later came to be known as the UCLA-Plasma Accelerators Group), started the first experimental program to demonstrate the most audacious prediction of this idea- that plasma waves could support 1 GeV/cm accelerating gradients. I will discuss what we were thinking in those early days and how a supportive high-energy physics community and funding agency were patient and instrumental in conclusive demonstration of acceleration of externally injected electrons by a relativistic plasma wave. Thereafter the plasma acceleration field rapidly spread worldwide as CPA lasers became commonplace. These lasers and GeV class charged particle beams provided by SLAC enabled rapid progress of the field that included high gradient acceleration of both electrons and positrons, acceleration of narrow energy spread beams containing a significant charge and high efficiency of energy extraction from wakes. At the same time some near term applications have emerged from the directional X-ray beams, tunable IR pulses, 100s of MeV class electron beams and intense THz pulses that can be generated using these wakes. As for the ultimate goal of building a plasma-based linear collider many basic problems still remain providing an opportunity for young scientists to make their mark on the field.

Working group

Invited plenary talk

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Session Classification: Plenary session